

Segmentation of Forensic Latent Fingerprint Images Lifted Contact-less from planar Surfaces with Optical Coherence Tomography

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Abstract

Lifting latent fingerprints through means that do not make contact with the surface where the fingerprint is imprinted, is advantageous in many ways. Some of these advantages include: being able to lift the print multiple times; there is no physical or chemical processing of a substrate required, the substrate can be concurrently analyzed for DNA for instance; and this can provide a non-destructive lifting of the fingerprint, something that can aid in scene preservation. In this paper, we present an automatic segmentation of latent fingerprint images lifted contact-less from planar surfaces using swept source optical coherence tomography. We do not perform any localization scans as we know the position of fingerprint impressions left on a substrate. The 3-D lifted scan is processed on a per cross-sectional image basis. First the cross-sections are filtered to reduce the effects of speckle noise, then the one dimensional Sobel edge detection is applied horizontally. The detected edge represents the substrate surface plus the latent fingerprint impression left on it. They are concatenated together to form a 2-D segmented image of the lifted fingerprint. After enhancement using contrast-limited adaptive histogram equalization, minutiae were extracted from the segmented images as an implicit quality evaluation procedure, on top of the subjective one carried out. Segmented images of latent fingerprints lifted off some substrates like glass and stainless steel were of sufficient quality for minutia extraction.